An Electrophysiologic View of Acupuncture: Role of Capacitive and Closed Circuit Currents And Their Clinical Effects in the Treatment of Cancer and Chronic Pain

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Abstract: Acupuncture may be directly related to the vascular-interstitial closed circuit (VICC) system. The latter represents an electrogenic mechanism for mass transport of material between blood and tissue. Its correlation to acupuncture is described. Grounding of the subcutis will modify the electrical charge by capacitive flow of current between tissue and ground. In this study comparisons were made of the local effects of the insertion of acupuncture needles. Analogues of local and distant effects of acupuncture are described, based on the mechanics of the VICC system. Equivalents to the meridians, the Yin and Yang patterning of Qi energies, are defined as preferential pathways for positive and negative ions of electric energy of the VICC system. The latter can be influenced by the introduction of needles, but may also be driven by electric power applied to electrodes, similar to electroacupuncture. Clinically beneficial effects from electrochemical treatment of cancer growth and cancer pain, as well as the induction of effects distant from the electrodes, are described.

THE PROCEDURES widely used in acupuncture are already well described in the literature[1-11] and various textbooks[12-14] and will therefore not be included here. The extensive use of acupuncture and the repeated demonstration of its beneficial effects represent strong "proof" of its validity. Nevertheless, many Western physicians are reluctant or hesitant to accept acupuncture. This is understandable as long as they require strict Western scientific proof.

A number of Western approaches have attempted to elucidate the mechanisms of acupuncture.[15-22] In particular, Sjölund and colleagues have suggested that acupuncture points are related to electrophysiologic events[20] and that "stimulation" of acupuncture needles with electricity is useful in electroacupuncture for electronarcosis[23-27] and in pain reduction.[17,20-22,24,27-31] However, these analyses fail to consider the electrical requirement for the presence of closed circuits in any electrobiological system.

The analysis presented in this paper offers an approach to understanding acupuncture based on current knowledge of such circuits.[32,33]

Vascular-Interstitial Closed Circuits (VICC system) and acupuncture.

A previously unrecognized system for long-distance electrogenic transport between blood and tissue has recently been described.[32,33] Representing a circulatory system in addition to that of the blood, it is named the "vascular-interstitial closed circuit" (VICC). Briefly, it can be characterized as an endogenous, electrophoretic mechanism which is powered both by metabolic potential differences among tis-

Keywords: Acupuncture, electrophysiology, capacitive currents, vascular-interstitial closed circuit system (VICC), meridians, ion transport, cancer growth, cancer pain.

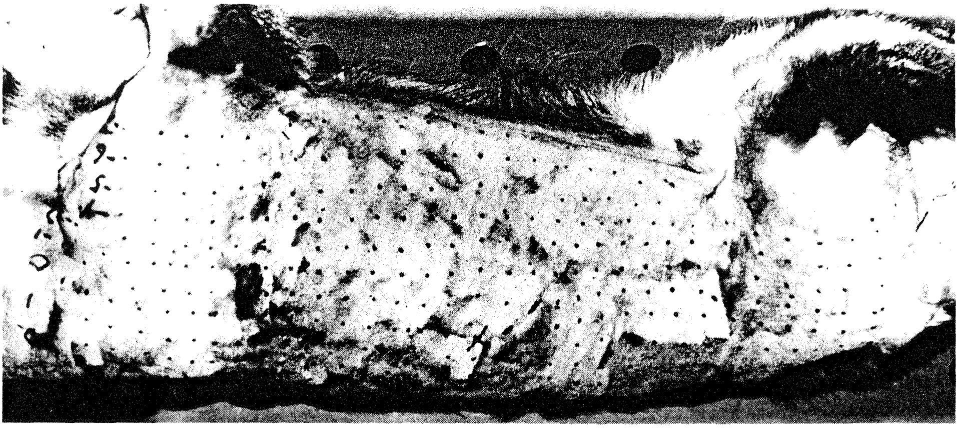

Figure 1a.

275 dots of ink were applied on the shaved side of a dog under general anesthesia.

sues and organs as well as by injury potentials. The differences in electric potential are leveled by closed circuit ionic transport over blood vessels and interstitial tissue channels. An electrical junction exists across capillaries between blood and interstitial fluid. The conductance of interstitial fluid is equivalent to that of blood plasma. In capillaries the cellular membranes of the endothelial cells contain necessary *electrode-equivalent* sites for electron transfer for rectification of the ionic transports. The interstitial channels may, at certain locations, form frequently utilized interstitial pathways for ionic currents which could very well correspond to the meridians in acupuncture terminology.

In this view, a separation of positive and negative collections of ions of the VICC system may correspond to what is called Yin and Yang energies. The electric energy driving the VICC system then might correspond to the Qi energy in acupuncture. If such an identity between VICC and the basis of acupuncture exists, the practice of acupuncture may be guided by manipulations of this powerful and important mechanism for electrogenic mass transport between blood and tissue. Such manipulations offer many practical advantages.

By considering the mechanics of the VICC system, the practitioner or investigator of acupuncture can now regard the properties of acupuncture in well-known electrophysiological terms, and predict how this system should be manipulated to produce specific effects. With such a view, the practice of acupuncture is no longer mysterious or unpredictable but rather, founded on basic morphological and functional facts.

Part I

Modulation of the electric charge in the subcutis of dogs.[32(chap 8)]

The common target organ in acupuncture is the subcutis. An example of how it can be modulated follows.

Three mongrel dogs received general anesthesia by intravenous injection of sodium pentobarbital. The hair on the right side of the body was shaved and 275-300 equally spaced dots were placed on the skin (see Fig. 1a). In each of the dogs a stainless steel needle electrode (E_r), with an outer insulation of Teflon except at its tip, was introduced into the subcutis at the end of the tail and grounded for approximately five hours (see Fig. 1b). This electrode was used as a reference for recording the differences of electric potential relative to another needle electrode (E_s), which was systematically introduced into the subcutis at each of the dots on the skin in three subsequent experiments. The measurements of electric

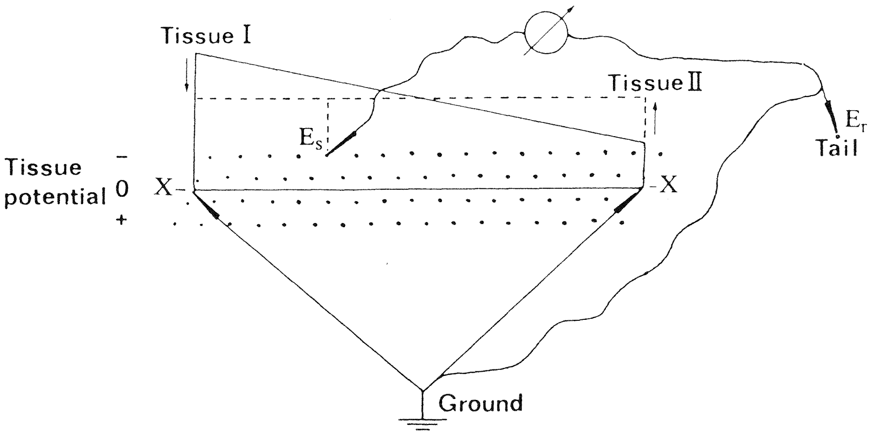

Figure 1b.

The subcutis of the tail was grounded and used as a reference (E_T) for electric potential measurements of the subcutis (E_S) under each dot. One point of the subcutis at the shoulder and one point at the hip were also grounded (X–X) shortly before the potential measurements in the first experiment.

potential were made with a Mark 220 Brush DC potential instrument with an input impedance of 10 megohms. Potential differences were monitored immediately after the introduction of the needle.

—Experiment I: Lengthwise ground.

Table 1 illustrates the numerical values, in millivolts, at each dot of one of the dogs relative to the grounded electrode in the tail. The two sites marked "X" in the table indicate the relative posititions of the additional electrodes, also connected to ground as indicated in Figure 1b.

In Figure 2a, string-lengths corresponding to the negative values in Table 1 were hung from a grid representation of the dots on the skin. When the grid was held parallel to the floor, the varied-length strings formed a three-dimensional or topographic display of the relative electric potentials. Figure 2b is an "end view" of the hanging grid in Figure 2a which reveals a "tunnel" (arrow) of reduced electronegative potentials between the two grounded electrodes (X–X).

The two grounded electrodes (X–X) were then removed, and the animal allowed to rest for one hour before the next experimental test on its subcutis was begun.

—Experiment II: Crosswise ground.

Two new pairs of grounding sites were then made at locations on an axis perpendicular to the axis in Experiment I. New measurements of the electric potential differences were taken (see Table 2). These numerical values were also displayed in the three-dimensional pattern with hanging white strings, as seen in Figure 3. It can now be seen that two new parallel tunnels (arrows) have developed between the pairs of grounded electrodes across the side of the animal (see Fig. 3a). The lengthwise tunnel from the first experiment had disappeared (see Fig. 3b). The animal was again allowed to rest for one hour without the grounding connections attached before the third part of the experiment.

—Experiment III: Random ground.

Ten random groundings were established on the subcutis over the side of the animal. New recordings of the electric potential differences are shown in Table 3. The three-dimensional displays are seen in Figure 4a and 4b. The white center squares represent the potential difference of zero in relation to the grounded tail. The upward lines are electropositive values and the downward are electronegative values.

Discussion of Experiments I, II and III

The experiments show that the subcutis was initially electronegative after five hours of electrical grounding of the subcutis of the tail. The relatively short-duration groundings of the side of the animal (Experiments I and II) showed regions with relative decreases in the electronegative potentials relative to ground, and in Experiment III with multiple groundings, even resulted in some positive potential differences.

The effects in the three experiments are caused by a capacitive flow of current between ground (a capacitor) and tissue, which contains cellular capacitors within larger capacitors (e.g. organs), surrounded in turn by capsules of electrically insulating fibrous tissue.

What Happens in the Subcutis During Acupuncture Treatment

The surface of every person's body carries an electric charge. When an acupuncturist introduces a needle into the subcutis of a patient, a potential difference is likely to exist between the subcutis of the patient and the acupuncturist's fingers. This will cause a capacitive flow of current, equalizing the potential difference. Depending on the relative charge of the acupuncturist and the subcutis of the patient, current may flow to the patient or from the patient. Moreover, when the needle perforates the surface of the skin of the patient (if the acupuncturist wears rubber gloves or if the needle is provided with an insulating handle), an equalization will also occur between the charge of the surface of the skin and the subcutis of the patient. The amount of charge and its flow on the skin of both the acupuncturist and the patient will also vary depending on the degree of skin moisture and atmospheric humidity.

How the capacitive flow of current will proceed through an acupuncture needle cannot be predicted unless the charge distributions and conductive properties of the tissues are known. The environment will determine the magnitude and direction of capacitive flow. Depending on the relative distribution of charges, effects will or perhaps will not occur during acupuncture.

The time interval in which the current is allowed to flow (in order to equalize potential differences between capacitors) will also produce various degrees of effect in living tissue. A charge or discharge of the subcutis will also occur depending on the conductive properties of the interstitial and/or vascular pathways among cells and across cellular and tissue-organ capacitors.

Current flowing across a metal-electrolyte interface always causes the formation of insulating deposits (electrode reactions). These deposits can be removed mechanically. Therefore, the increased effect in acupuncture caused by "drilling" (twirling) an inserted needle can simply be looked upon as corresponding to increased ionic flow due to the mechanical cleaning of the electrodes used in electrophoresis.

Many of these variables may be addressed directly if we are ready to conclude that acupuncture is basically a manipulation of the electrical system of the body. Such a view will lead to various electrochemical possibilities.

Local effects by changing the electrochemical environment.

A local, relatively slow influence on the charge of a tissue region is evidently possible by a capacitive flow of electric current via an inserted needle. It is well known that colloids are kept suspended by their zeta potential[34] in relation to the opposite ionic charges and to the molecular concentration forces in the surrounding liquid (see Fig. 5). By lowering the zeta potential difference to zero (see Table 4), the affected colloids will precipitate.[35] Such changes can drastically influence ionic membrane transports in normal or pathologic cells. In addition to diffusion and metabolic events, it should be evident that normal *circulation* of blood and tissue fluid might also influence induced electrochemical changes of tissue. Counteracting such electrochemical effects might then involve measures to influence local circulation or the use of, e.g., metabolically modifying agents.

The flow of current between anodic (+, acid) *and cathodic* (−, base) *tissue sites, as well as influences on the distribution of chemical reactants will contribute to the formation of new chemical compounds.* Electroacupunc-

						70	75	70	70	65	70	70	70	60	60	55	55	50	45	40	40	35	32	30	30	28	25	35	25	30	
					50	45	45	50	50	45	55	50	50	52	52	50	50	52	50	50	55	60	55	52	55	70	65	70	75	75	
			60	65	65	70	65	70	55	60	60	55	55	75	70	75	80	70	70	75	60	75	75	75	55	40	40	40	35	40	
		52	50	52	50	48	45	48	45	44	46	52	50	52	50	55	50	48	50	45	45	45	35	30	32	35	35	32	42	32	
	52	52	48	46	45	48	48	50	50	52	52	50	48	45	45	50	44	48	42	44	50	38	35	32	32	38	30	24	40	20	X
X	05	12	15	20	20	18	22	24	25	25	25	24	22	10	15	20	22	22	23	25	24	25	24	26	18	25	24	22	25	26	
	32	30	30	28	30	28	28	30	30	28	26	30	28	32	32	30	30	28	30	25	22	24	24	25	24	26	24	22	20	16	
	15	20	18	22	24	24	28	28	30	30	30	28	28	35	38	35	34	34	32	30	35	36	32	30	32	32	42	38	34	38	
		40	35	40	40	35	32	30	32	30	32	38	35	35	34	34	36	36	38	32	30	30	28	25	28	25					
		25	40	25	28	25	30	28	28	30	32	28	34	30	32	35	38	40	40	38	38	40	42	48							

Table 1.

Numerical values in millivolts with subcutis relatively negative to the grounded tail were read and noted by one person while another person introduced the "exploring" electrode under each dot of the subcutis. In this particular experiment, two extra groundings are indicated by (X-X). (See also Fig. 1b).

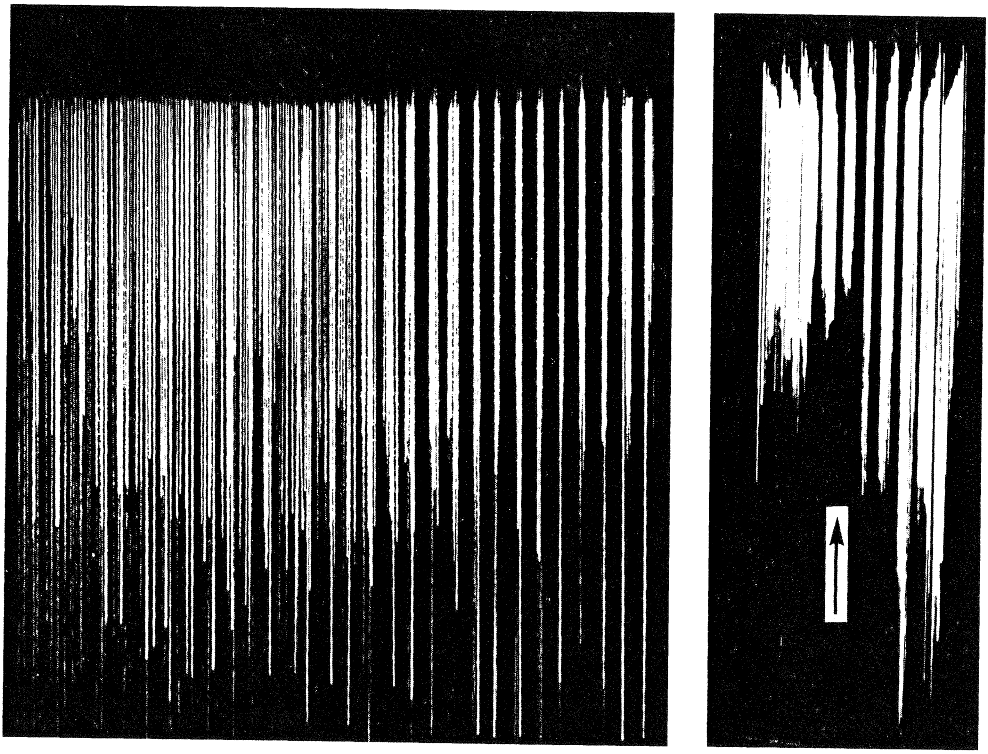

Figure 2a

Figure 2b.

Three-dimensional display of the potential values presented in Table 1 by the use of hanging white strings, which are photographed from the side (a) and lengthwise (b). Fig 2b shows a "tunnel" (arrow) of lowered negative values between the groundings (X-X).

						X										X												
					40	25	40	48	48	42	46	35	38	32	38	35	35	45	42	48	50	50	50	55	50	65	60	
			40	38	36	28	38	48	45	46	45	35	35	30	45	32	32	42	42	48	50	50	52	50	50	60	60	
		28	40	36	35	30	35	40	45	46	40	36	35	32	42	30	30	42	45	47	55	55	55	50	55	60	60	
	42	28	40	40	30	30	38	40	45	42	38	40	32	35	38	30	36	40	45	42	50	50	55	50	55	55	70	55
42	40	30	40	40	30	32	40	38	48	42	40	40	32	32	42	26	38	42	46	42	55	55	50	50	60	50	70	52
40	45	32	38	40	30	28	38	38	48	48	40	42	42	32	40	24	35	40	42	40	55	55	52	52	70	55	70	52
42	42	32	38	40	30	30	36	40	50	42	40	40	35	36	42	28	35	40	40	42	60	55	50	50	55	50	70	55
50	42	36	40	40	30	32	35	38	48	50	40	40	35	35	40	24	36	38	42	40	60	55	52	50	60	55	65	55
	45	38	42	40	30	32	30	40	45	46	40	42	32	38	35	22	38	36	40	40	55	60	55	45	60			
	42	40	42	40	28	30	30	40	40	48	42	40	32	38	40	20	40	38	40	40	60	75	70					
					X												X											

Table 2.

After removal of the groundings (X-X) and one hour of recovery, four new groundings were performed on the subcutis $\begin{smallmatrix} x & x \\ x & x \end{smallmatrix}$, perpendicular to the first pair, and followed by systematic recording of the potential differences. All measurements show subcutis electronegative (minus sign omitted) in relation to ground.

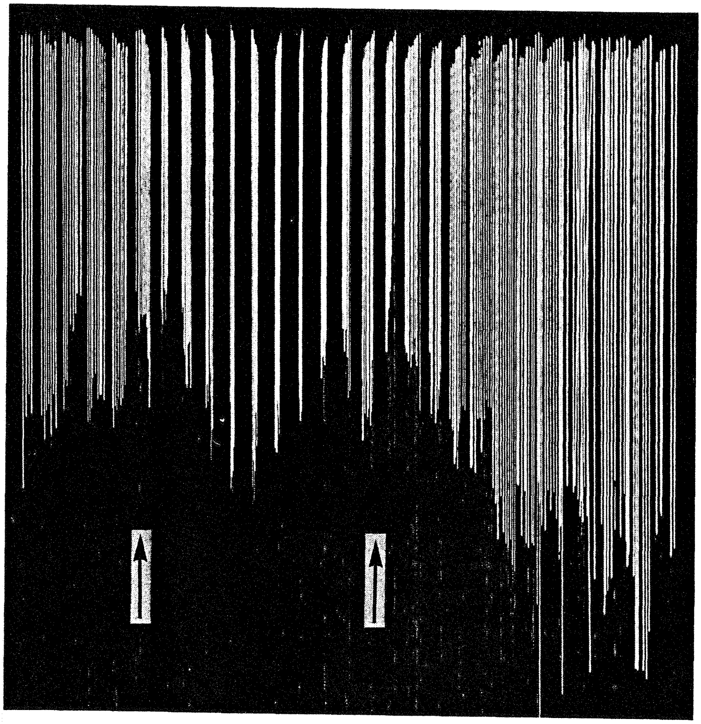

Figure 3a.

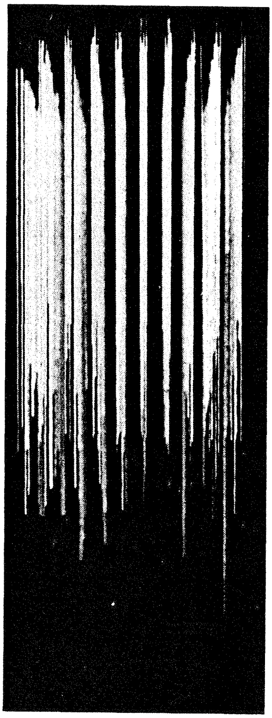

Figure 3b.

The values from Table 2 displayed in the same manner as Fig. 2. (a) This later view now shows two new "tunnels" (arrows) between the two new pairs of grounding sites. (b) In the lateral view the previous lengthwise "tunnel" of Fig. 2b has disappeared.

				10	12	10	8	5	4	2	1	+5	+6	+1	+5	+14	+2	+2	2	0	0	2	0	+2	7	4	5	4	+4	0
		10	10	4	10	8	5	5	5	2	0	+4	+8	2	+4	+15	+2	+1	0	+2	0	2	+2	0	6	3	4	1	+2	0
8	8	10	12	5	6	6	10	6	8	2	5	+4	+5	0	+4	+2	+3	+2	+5	0	0	0	+5	0	6	5	4	2	+2	0
8	10	10	12	8	10	5	8	6	8	2	6	+4	+5	0	0	+2	+4	+2	0	0	0	2	+5	1	4	6	4	3	0	0
8	10	8	12	10	10	6	4	8	8	+8	5	0	0	0	10	+5	+6	+3	0	1	+2	0	+6	5	4	5	4	4	0	4
8	10	10	12	10	6	6	2	8	5	+8	2	0	2	0	+4	+5	+6	+3	2	1	0	+2	2	5	4	5	+8	5	0	6
12	8	10	10	10	10	8	2	10	5	+5	2	1	4	0	+4	+6	+6	+5	+2	0	2	+4	+10	6	4	12	20	6		4
20	5	18	10	10	12	8	4	8	5	+6	2	4	1	2	+3	+5	0	+5	0	0	0	+2	+2	4	8	5	12	5		
15					5	8	5	8	10	+4	4	4	0	0	+3	+8	+8	+4	0	0	+4	0	+5	4	8	+10	12	15		
5								8	0	0	0	5	0	0	+7	+9	+7	+4	+2	+2	+8	2	+8	4	4	+10	10	4		
10								5	0	0	+4	4	+1	0	+7	+10	+8	+4	+2	+8	+12					+5	0	4		

Table 3.

After removal of the previous groundings indicated in Table 2 and after one hour of recovery time, ten groundings were performed on the subcutis of the side of the animal, followed by electric potential recordings in millivolts under each dot. All electronegative values of the subcutaneous potential were now lower (minus sign omitted) and some were even positive in relation to the subcutis of the tail.

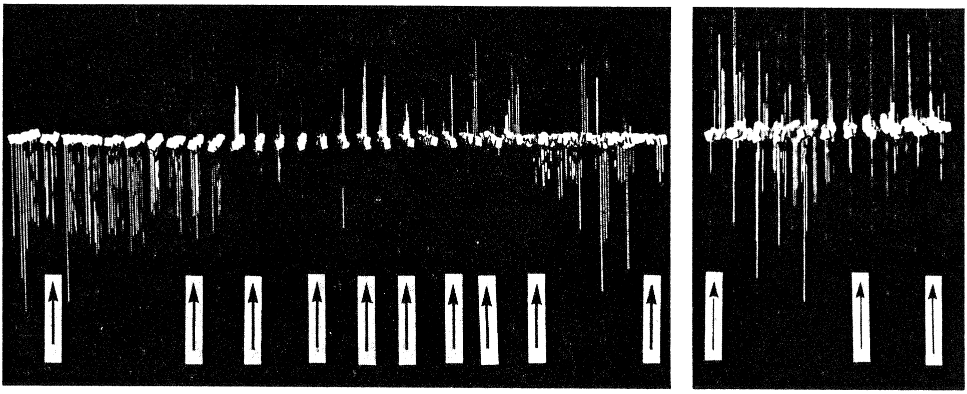

Figure 4.

Display of the potential values of Table 3 shows large areas of the subcutis of very low negative potential. Some even show positive values. The white markers on the strings represent the baseline value of ground, indicating a difference of potential of zero.

ture analgesia has been described as eliciting the production of endorphins.[15,18,20,22,24-27,36-39] Such mechanisms may therefore be related to induced electrochemical reactions. Further, cells sensitive to changes of the ionic microenvironment, such as malignant cells, have even been shown to regress.[32:p.269-317]

In the present traditional view, electrochemical differences among tissues are abolished by diffusion and circulation. Diffusion takes place slowly, circulation relatively rapidly. This would be analogous to a galvanic battery discharging slowly on the shelf (diffusion) versus its rapid discharge (circulation) through an attached light bulb). *In vivo* the rapid discharge is what happens in the VICC system between polarizing tissue regions.

Another effect we can recognize from the animal experiments is the presence of a relatively electronegative subcutis in relation to ground. A temporary decrease (as evidenced by the "tunnels") of the electric potentials was restored by the metabolic activities of the tissues. By means of an external source of electric energy the relative electronegative charge of a tissue region can also be changed.

In order to increase or decrease local tissue potentials with acupuncture, all the above factors may be utilized. It is therefore important to know what kind of influence one desires and how this can be optimized. Likewise, in addition to acupuncture, one should know which type of procedures would be appropriate. Other measures which interact with the electrical systems of the body (e.g. massage, heat, blocking of circulation or the use of agents influencing metabolism) should be considered.

Distant effects by induction of ionic flow through the VICC system.

A local change of the electric charge of a tissue region, e.g. by means of a needle introduced through the skin, may also produce distant effects in a living patient.

This is possible over the VICC system,[32,33] which forms closed-circuit conductive pathways for endogenous flow of currents between blood and tissue. Various degrees of influences may then occur among spontaneously polarizing processes such as metabolic events or injury potentials. A local polarization or depolarization induced by a needle introduced into the skin may also induce a flow of current between polarizing processes that are situated at a distance from the needle when preferential conductive pathways for ions ("meridians") are available. In this mechanism, *not only the "meridian" but also the associated vascular "return" pathway of the VICC system is activated.* In other words, we are modulating the electric energy (Qi?) between polarizing tissue regions.

Polarization due to, e.g., chemical, infectious or other pathological processes, can therefore be modulated. To what extent such effects will occur, and whether an induced modulation is desirable or undesirable should be known beforehand. Beneficial effects are often reported in acupuncture, but logically, adverse effects should also sometimes occur. Additional effects with acupuncture may also be obtained by short-circuiting adjacent conductive ionic pathways (meridians) as described previously.[32(pp.328-332)] Evidently, preferential pathways (meridians) for current exist not only in the subcutis, but also deep in the body between organs.

Part II

External supply of electric energy for treatment of cancer.

By delivering current from an external source of electric power through *acupuncture needles (electrodes)*, current can be transferred over interstitial and/or vascular components of the VICC system. This procedure has been performed in attempts to influence the growth of cancer[32(chap 17)] in a manner which can be regarded as a variation of "electroacupuncture." This procedure makes use of direct current and utilizes the principle of electrophoresis. *In vivo*, only direct current flows in tissue. Therefore, the application of high frequency alternating currents may be unphysiologic and contraindicated for the biological substrate. It is possible, however, to obtain injury in tissue with the use of high frequency alternating currents, which produce heat.[32(pp.272-281)] Small tumors have been destroyed in this way.

In various, but not all, types of cancer it was possible to observe a slow, continuous dis-

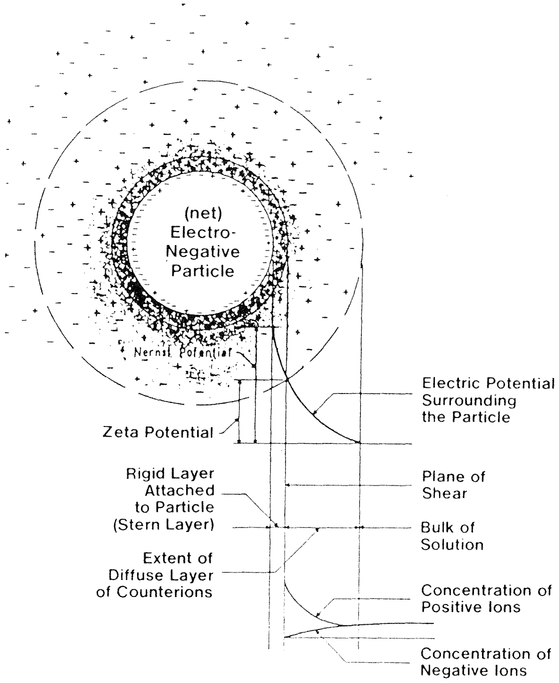
(net) Electro-Negative Particle
Nernst Potential
Zeta Potential
Electric Potential Surrounding the Particle
Rigid Layer Attached to Particle (Stern Layer)
Plane of Shear
Bulk of Solution
Extent of Diffuse Layer of Counterions
Concentration of Positive Ions
Concentration of Negative Ions

Figure 5.

The zeta potential[32] of a colloid. A net electronegative particle in a colloid will attract positive ions to its surface, balancing the charge of the particle (the firm or rigid layer). The concentration of attracted ions will attract more ions of the same kind and produce a "slipping plane" of potential, decreasing outwardly in concentration of ions, which forms the zeta potential. This potential in relation to the surrounding electrolyte keeps colloid particles in a suspended state.

Table 4.

A colloid of living tissue is stable when it is suspended by strong electrical forces. By levelling the electronegative potential, as in the dog experiments, the colloids (proteins) will precipitate, thereby seriously interfering with the function of tissue.

Stability Characteristics	**Avg. Zeta Potential in millivolts**
Maximum agglomeration and precipitation	0 to +3
Range of strong agglomeration and precipitation	+5 to −5
Threshold of agglomeration	−10 to −15
Threshold of delicate dispersion	−16 to −30
Moderate stability	−31 to −40
Fairly good stability	−41 to −60
Very good stability	−61 to −80
Extremely good stability	−81 to −100

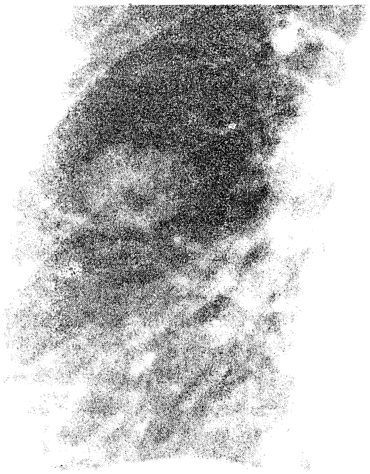

Figure 6a.

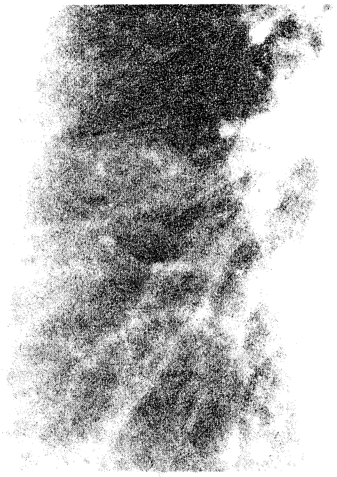

Figure 6b.

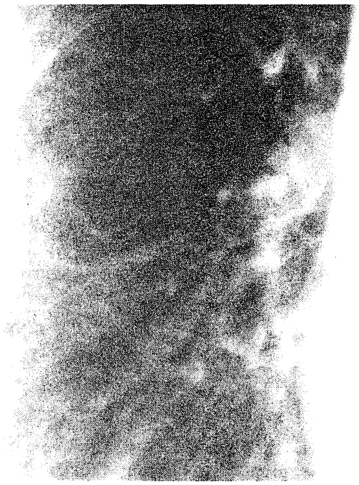

Figure 6c.

(a) Frontal view of a solitary adenocarcinoma metastasis in right lung of a woman who had previously been treated with mastectomy. Because of age and condition, she was considered inoperable. After percutaneous insertion of one electrode into the tumor and another into the lung outside the tumor, electrochemical treatment was performed. The tumor was made electropositive. One treatment under local anesthesia was performed at 10 volts with 200 coulombs. The cancer tissue, apparently sensitive to these changes in its microenvironment, started to regress. (b) Two months later. (c) After 11 months, the metastasis had disappeared. Now 4 years after treatment the patient is in good health without relapse.

appearance of the tumors after *electrochemical treatments* with direct current (Fig. 6a-c). The primary idea for the procedure was to destroy the tumor. By gentle application of electrophoresis, with one electrode in the tumor and one electrode in the surrounding tissue, the ionic composition of the tissue fluids around the tumor can be changed. The tumor cells are known to be more sensitive than normal cells to changes of the microenvironment, which is the common basis for all contemporary cancer therapies, with the exception of surgery. Such "electroacupuncture," or *in vivo* electrophoresis, will evidently also change the microenvironment of the cancer cells in the electric field, and thus, explains the effect on tumors with the advantage of minimal side-effects.

External supply of energy for the induction of "referred pain."

Interesting distant effects were observed with the use of electrochemical treatments, which may have a relation to similar effects during acupuncture or so-called 'referred pain.'

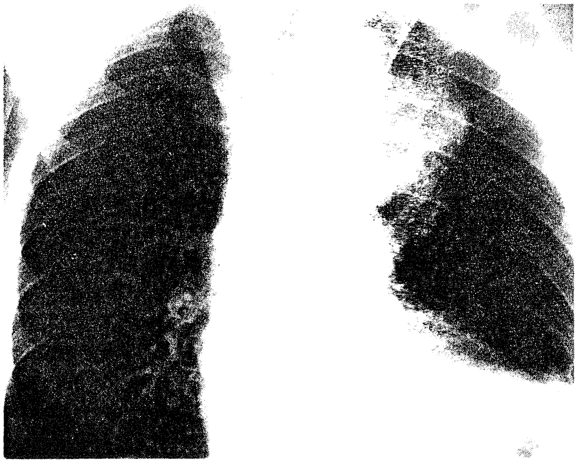

Figure 7.

Large inoperable primary squamous cell carcinoma invading mediastinum of a 70-year-old man. He had suffered from continuous intense cancer pain for four months. Palliative electrochemical treatment was attempted with a positive electrode in the tumor and a negative in the lumen of the aorta. After one hour of treatment (230 coulombs at 10 volts), all pain from his tumor region had disappeared. The pain remained absent for another three months, when the patient died of his disease. The cause of disappearance of the pain is obscure but may be related to electrochemical influence on the cancer tissue preventing the production of histamine, substance P and bradykinin. Nerve destruction or release of endorphins cannot explain the long lasting effect.

Examples will therefore be described.

1. In a patient with breast cancer, a potential difference was applied between an electropositive electrode placed in a metastasis in the lower lobe of the right lung and an electronegative reference electrode in the parenchyma of the same lobe 7cm superolateral to the tumor. The patient reported that intense pain was felt in the right inner ear when the voltage was slowly increased to 10-15 volts. When the potential difference was decreased to about 8 volts, all pain disappeared. By increasing and decreasing the voltage it was possible to repeatedly induce or abolish the pain.

2. In an adult man, current was passed from a cathode in the aorta over the bronchomediastinal arteries to an anode implanted in a grapefruit-sized retrocardiac squamous cell carcinoma. The distance between the electrodes was about 10cm. At 10 volts the patient reported intense pain in the left-upper jaw, where he recently had had a metallic dental filling installed. When the voltage was decreased to 8 volts, the pain disappeared. It returned again at 10 volts. As with the other patient, these events could be repeated.

In other patients treated electrophoretically for lung tumors, dull to intense pain in the ipsilateral shoulder or in the epigastric region was sometimes reported. In each instance, these symptoms could be induced at certain voltages and disappeared upon decreasing the voltage.

In all cases the symptoms occurred in tissue regions situated at relatively remote distances from the electrodes. Inevitably, these symptoms would be compared with so-called "referred pain," still a poorly defined phenomenon, which has been ascribed to being transmitted over nerves, as well as associated with the so-called Qi sensations in acupuncture.

In these clinical cases, where voltage was applied between one electrode in the tumor and another in the surrounding tissue or in the nearby aorta, current is presumed to have passed over the shortest, least-resistant electrical route. When the voltage was increased sufficiently between the electrodes, conductivity over an accessory, parallel pathway is presumed to have been established. Such "openings" of accessory pathways are likely to occur at sites where ionization due to pathological processes such as thrombosis, infarction or other degenerative processes, infection, polarizing dental fillings or surgical metal implants, etc. have increased local conductivity.

Similarly, currents may also be induced spontaneously *in vivo* among the various conductive pathways (*meridians*) without the insertion of needles and/or electrodes.

External supply of energy for relief of chronic pain.

A continuous, intense, dull pain is often reported in connection with the growth of cancer. It destroys the quality of the patient's life and is difficult to relieve by various analgesics. Electrically stimulated release of endorphins[23-31,36,37] usually abolishes the pain for only 2-4 hours. In peripherally located regions, so-called "yin pain" is said to be relieved by pressure or massage.[38,39]

In four chest tumors it was possible to demonstrate the influence of electrochemical treatment on tumor pain. In Fig. 7, a squamous cell cancer is seen in a radiograph of a 70-year-old patient who had suffered from continuous, intense pain for 3 months. As surgery, radiation and chemotherapy were considered impossible to apply, electrochemical treatment was accepted for palliation. With an electronegative electrode in the lumen of the aorta and an electropositive electrode inserted into the tumor, direct current was applied at 10 volts. During a 2-hour period, 230 coulombs of electric charge were delivered. After about one hour of treatment, the patient reported that the pain in the tumor region had disappeared completely. The pain did not recur during the remaining three months of the patient's life. Similar effects have been observed in three other patients with large intrathoracic cancers. In all of them, the anode was positioned in the tumor.

The explanation for the relief of pain in these tumor cases is still not clear. Destruction of nerve endings appears highly unlikely. Amputation pain should appear after some time. Liberation of endorphins with an effect lasting weeks to months appears equally unlikely. A more plausible explanation may be that each tumor will undergo regression and become dehydrated by electro-osmosis. This could lead to the blocking of the production of histamine, substance-P and bradykinin in the tumor tissue.

As may be seen from the clinical examples presented, beneficial effects can be obtained by the use of direct current. Evidently, it is also possible to induce a flow of ionic current with acupuncture. It remains to be determined whether such an induction of current is sufficient or whether support from an extracorporeal source of electric energy is needed.

Conclusions

In this study it is emphasized that the use of acupuncture, with its beneficial effects, should be seriously considered by "Western medicine" as an important approach for influencing various medical disorders.

It is also emphasized that the acupuncture meridians may constitute preferential pathways for ionic current through the vascular-interstitial closed circuit system. Consequently, the flow of the components of life energy (Qi), described as Yin and Yang, may possibly correspond to the positive and negative ionic energy of the VICC system.

By recognizing the VICC system as an underlying biological mechanism for the phenomena induced by the use of acupuncture, it should now be possible to define and study acupuncture in Western terms. An extended knowledge of the endogenous (and exogenous) influences on the VICC system should also make it possible to select specific VICC/acupuncture intervention in order to obtain suitable effects in various biological disorders.

Bridges of understanding between traditional Chinese medicine and Western medicine will yield advantages to all of us.

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